**CAMBRIDGE INTERNATIONAL EXAMINATIONS**

**Cambridge International Advanced Subsidiary and Advanced Level**

# MARK SCHEME for the October/November 2014 series

## 9702 PHYSICS

**9702/21** Paper 2 (AS Structured Questions), maximum raw mark 60

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| | | | | |
|---|---|---|---|---|
| **1** | **(a)** | temperature<br>current<br>(allow amount of substance and luminous intensity) | B1<br>B1 | <br>[2] |
| | **(b)** | base units of force constant: $\text{kg m s}^{-2}\text{m}^{-1}$ or $\text{kg s}^{-2}$<br>base units of time and mass: s and kg<br>base units of $C$: $\text{s}(\text{kg s}^{-2}/\text{kg})^{1/2}$ cancelling to show no units | B1<br>C1<br>B1 | <br><br>[3] |
| **2** | **(a)** | pressure = force / area (normal to the force) [clear ratio essential] | B1 | [1] |
| | **(b) (i)** | $P = mg / A = (5.09 \times 9.81) / A$ | C1 | |
| | | $A = (\pi d^2 / 4) = \pi \times (9.4 \times 10^{-2})^2 / 4$ (= 0.00694 m$^2$) | C1 | |
| | | $P = 49.93 / 0.00694$<br>$= 7200$ (7195) Pa (minimum of 2 s.f. required) | <br>A1 | <br>[3] |
| | **(ii)** | $\Delta P / P = \Delta m / m + 2\Delta d / d$ | C1 | |
| | | $= 0.01 / 5.09 + (2 \times 0.1) / 9.4$ (= 0.0020 + 0.021 or 2.3%) | C1 | |
| | | $\Delta P = 170$ (165 to 167) Pa | A1 | [3] |
| | **(iii)** | $P = 7200 \pm 200$ Pa | A1 | [1] |
| **3** | **(a)** | <u>random</u> error (in the measurements) of the length OR resistance | B1 | [1] |
| | **(b)** | gradient = (3.6 – 1.9 ) / (0.8 – 0.4)<br>= 4.25 | C1<br>A1 | <br>[2] |
| | **(c)** | $R = \rho l / A$ | C1 | |
| | | $\rho$ = gradient × area = $4.25 \times 0.12 \times 10^{-6}$ | C1 | |
| | | $= 5.1(0) \times 10^{-7}\,\Omega\,\text{m}$ | A1 | [3] |
| | **(d)** | resistance decreasing with increasing area<br>correct shape with curve being asymptote to both axes | B1<br>B1 | <br>[2] |

| | | | | |
|---|---|---|---|---|
| **4** | **(a) (i)** | acceleration = $(v - u) / t$ or $(12 - 0.5) / 4$ | C1 | |
| | | = $(12 - 0.5) / 4$ = 2.9 (2.875) (= approximately $3\,\text{m s}^{-2}$) | M1 | [2] |
| | **(ii)** | $x = (u + v)t / 2$ | | |
| | | = $[(12 + 0.5) \times 4] / 2$ | C1 | |
| | | = 25 m | A1 | [2] |
| | **(iii)** | line with increasing gradient | M1 | |
| | | non-zero gradient at origin | A1 | [2] |
| | **(b) (i)** | weight down slope = $2 \times 9.81 \times \sin 25°$ = 8.29 / 8.3 | M1 | [1] |
| | **(ii)** | ($F = ma$) $8.3 - F_R = 2 \times 2.9$ | C1 | |
| | | $F_R$ = 2.5 (2.3 if 3 used for *a*) N | A1 | [2] |
| **5** | **(a) (i)** | change in kinetic energy = $\frac{1}{2}mv^2$ | C1 | |
| | | = $0.5 \times 25 \times (0.64)^2$ = 5.1(2) J | A1 | [2] |
| | **(ii)** | zero | A1 | [1] |
| | **(iii)** | (–) 5.1(2) J | A1 | [1] |
| | **(b) (i)** | PE = $mgh$ | C1 | |
| | | = $350 \times 0.64 \times 25$ | C1 | |
| | | = 5600 J | A1 | [3] |
| | | *(If full length used allow 1/3)* | | |
| | **(ii)** | $P = Fv$ or gain in PE / $t$, $E_P / t$ or work done / $t$, W / $t$ | C1 | |
| | | = $350 \times 0.64$ or 5600 / 25 | | |
| | | = 220 (224) W | A1 | [2] |
| **6** | | melting: solid to liquid | B1 | |
| | | at a specific / one temperature / at the melting point | B1 | |
| | | evaporation: liquid to vapour / gas OR molecules escape from surface of liquid | B1 | |
| | | at all temperatures | B1 | [4] |

**7** **(a)** due to the lost volts in internal resistance / cell or energy losses in the internal resistance / cell — B1 [1]

**(b)** **(i)** $V = IR$ — C1

$= 1.2 \times 6 = 7.2\,\text{V}$ — A1 [2]

**(ii)** p.d. across Y and internal resistance $r$ = 4.8 (V) [12 – 7.2] — C1

resistance of Y + $r$ = 4.8 / 1.2 = 4 (Ω) — C1

resistance of Y = 4 – 0.5 = 3.5 Ω — A1 [3]

*or*

$R_{\text{total}}$ = 12 / 1.2 = 10 (Ω) — (C1)

X + $r$ = 6.5 (Ω) — (C1)

resistance of Y = 3.5 Ω — (A1)

**(iii)** $P = I^2 r$ — C1

$= (1.2)^2 \times 0.5 = 0.72\,\text{W}$ — A1 [2]

**(c)** terminal p.d. increases as $R$ is increased
current decreases so there are less lost volts — B1 [1]

**8** **(a)** two waves (of the same kind) travelling in opposite directions overlap — B1
waves have same frequency / wavelength and speed — B1 [2]

**(b)** **(i)** $T$ = 0.8 (ms) — C1

$f = 1 / (0.8 \times 10^{-3}) = 1250$ (Hz) — A1 [2]

**(ii)** microphone is moved from plate to loudspeaker or vice versa — B1
wavelength is the twice the distance between adjacent maxima or minima (seen on c.r.o.) — B1 [2]

**(iii)** $v = f\lambda$ — C1

$= 1250 \times 0.26$

$= 330\ (325)\,\text{m s}^{-1}$ — A1 [2]